Application of Remotely Sensed Data to Regional Analysis and Assessment of Stream Temperature in the Pacific Northwest Streams

Rebecca Handcock[1], Camille Russell[1], Keith Cherkauer[2], Jennifer Kay[1], Alan Gillespie[1], Stephen Burges[2], Derek Booth[1,2]

[1] Department of Earth and Space Sciences, University of Washington.
[2] Department of Civil and Environmental Engineering, University of Washington.

Background

This 3-year project, funded by the U.S. Environmental Protection Agency, focuses on stream temperatures as a key water-quality parameter. The principal goals of this work (begun in April 2000) are to develop efficient methods for regional assessments of stream temperature and to demonstrate how the methods can be applied to assess effects of land use on stream temperature. We have selected water temperature to illustrate and explore methods for regional water quality assessment because water temperature is biologically important; it is affected by anthropogenic activities; and surface (skin) temperature can be measured from remote instruments that detect TIR signals. The ecological integrity of many rivers and streams in Washington State are threatened by elevated temperature.

The remote sensing component of this work focuses on the information (data quality) lost when using remote platforms (i.e., aircraft and satellite) to determine temperature; and to characterize the types of stream that are amenable to remote temperature monitoring. If stream temperatures can be estimated from images with known and acceptable levels of confidence, then regional temperature assessments will be less sensitive to the uncertainty associated with sampling temperature at a relatively small number of ground stations.

This project has had an extensive field component with a network of stream temperature probes deployed in sites in the Green and Yakima River basins. In conjunction with this work remotely sensed images have been collected from satellite (ASTER, Landsat) and air-borne platforms (MASTER, 2001) as well as ground-based observations made using the FLIR.

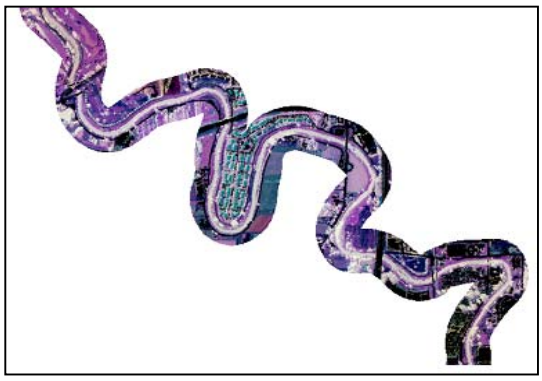
Key issues affecting the accuracy of temperatures derived from remotely sensed TIR data include accurate atmospheric correction, sub-pixel unmixing, and the spatial distribution of stream temperatures. The first part of this talk will focus on the image-processing issues involved with generating a useable image of stream temperatures using this data (Camille Russell). The second component of this presentation will focus on how scaling issues affect the accuracy of TIR derived stream temperatures (Rebecca Handcock). Both of these topics are components within the larger context of integrating remote sensed data with existing temperature networks.

Project web site: http://depts.washington.edu/strmtemp/

Part 1) Water radiant-temperature analysis of the Duwamish/Green River using high-resolution, hyper-spectral, air-borne imagery *(Camille Russell, crussell@u.washington.edu)*

The goal of this project, completed Fall 2002, was to calculate radiant skin-temperature of the Green/Duwamish River in King County, Washington by applying a series of radiometric and geometric processes to hyper-spectral, remotely sensed imagery. This collaborative endeavor assists scientists and biologists concerned with salmon habitat planning, monitoring and assessment, and is associated with King County's Water Resource Inventory Area (WRIA) 9.

For more information see:
http://depts.washington.edu/strmtemp/DOCS/camille_GreenR_processing_summary.doc



Spatial "Buffer" –

Part 2: Issues of multi-scale spatial variability in remotely sensed data *(Rebecca Handcock, rebeccah@u.washington.edu)*

With the increasing use of remote sensing there has been growing interest in the relationship between the scales of the phenomena, observation, and analysis. This size/resolution relationship is critical to the thermal remote sensing of streams because of the relationship between the stream size and the resolution and extent of the images. The goal of this presentation is to examine how the spatial scales of data and observation affect the ability to resolve stream temperatures, and the associated level of uncertainty.

For more information see: http://depts.washington.edu/strmtemp/